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Rubber-Processing Chemicals Data Base

SRI International, Menlo Park, CA

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Industrial Environmental Research Lab.
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THE RUBBER-PROCESSING CHEMICALS DATA BASE

by

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Contract No. 68-03-2934

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The objective of this research program was to compile a data base covering all the commercially significant organic rubber-processing chemicals produced or imported in the United States.

The Rubber-Processing Chemicals Data Base contains the following elements: chemical information (identification numbers, chemical names, synonyms, and identifiers); economic information (production, sales, and unit cost); use information; product process information; and chemical producer information (company and plant site identifiers, their locations, and the associated river basins and Air Quality Control Regions).

Data were compiled on 327 commercial products from a variety of sources, including on-line information retrieval systems, government statistical and research publications, standard industry handbooks, and in-house technical expertise. Correlation of data is accomplished by means of a System 2000® data base management system, which permits retrieval on the basis of various "key" data elements.

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FOREWORD

When energy and material resources are extracted, processed, converted, and used, the related pollutional impacts on our environment and even on our health often require that new and increasingly more efficient pollution control methods be used. The Industrial Environmental Research Laboratory--Cincinnati (IERL-CI) assists in developing and demonstrating new and improved methodologies that will meet these needs both efficiently and economically.

The Rubber-Processing Chemicals Data Base was developed as a specialized extension of the existing Organic Chemical Producers Data Base focusing on the commercial products of a particular industry. The data are assembled so that specific products and the wastewater emissions associated with their manufacture may be correlated with plant site locations and the river basins in which the effluents are deposited. This type of information should be especially significant to chemical engineers concerned with wastewater treatment and to aquatic environment ecologists. The Industrial Pollution Control Division may be contacted for further information on the Rubber-Processing Chemicals Data Base.

David G. Stephan
Director
Industrial Environmental Research
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Cincinnati

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ABSTRACT

The objective of this research program was to compile a data base covering all the commercially significant organic rubber-processing chemicals produced or imported in the United States.

The project was designed to be a supplement to the already extant Organic Chemical Producers Data Base. Whereas the latter included large-volume chemicals of general industrial use, the Rubber-Processing Chemicals Data Base was restricted to products within the narrow scope of a single end use category, but used a much lower annual production figure as the criterion for inclusion in the data base.

Data were gathered on the data elements included in the most recent form of the OCPDB, with the exception of a few elements which were not applicable or for which information was unavailable. These elements were grouped under the following headings: chemical information (identification numbers, chemical names, synonyms, and identifiers); economic information (production, sales, and unit cost); use information; product process information; and chemical producer information (company and plant site identifiers, their locations, and the associated river basins and Air Quality Control Regions).

Data were compiled on 327 commercial products from a variety of sources, including on-line information retrieval systems, government statistical and research publications, standard industry handbooks, and in-house technical expertise. Correlation of data is accomplished by means of a System 2000® data base management system, which permits retrieval on the basis of various "key" data elements.

This report was submitted in fulfillment of Contract No. 68-03-2934 by SRI International under the sponsorship of the U.S. Environmental Protection Agency. The report covers the period from November 1, 1981, to March 31, 1983, and the work was completed as of March 31, 1983.

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SECTION 1

INTRODUCTION

In 1976, the U.S. Environmental Protection Agency established the Organic Chemical Producers Data Base (OCPDB), a computerized information system which contained data on about 380 high volume industrial organic chemicals and their production sites. In 1979, the OCPDB was expanded to over 600 chemicals and 1400 producers, and it was placed on System 2000®, a data base management system. (System 2000 is a registered trademark of Intel Corporation.) A listing of the data elements in the OCPDB at the time the work on this project was started is given in Table 1.

The IERL has since decided to develop extensions of the OCPDB to include data on selected additional chemicals. The first new category, which is currently being completed by SRI International, treated organic dyes and pigments. The second new category, to be covered by this report, is commercially significant organic chemicals used to process natural and synthetic rubber. The chemical products included are listed in Appendix A.

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TABLE 1. DATA ELEMENTS IN THE OCPDB AT THE START OF THIS PROJECT

Entry Type	Data Element
Chemical information	Chemical I.D. number
	Chemical name
	CAS number
	New chemical marker
	Priority pollutant marker
	Wiswesser line notation
	NIOSH registry number
	Synonyms
Economic information	Year
	Production volume
	Unit cost
	Sales value
Use information	Chemical or allied product
	Use description
	Amount
	Percent domestic use
	IPPEU reference number
	SIC code
	Product application
Product process information	Process I.D. number
	Process description (brief)
	IPPEU reference number
	Reaction component
	OCPDB number
	ICPDB number
	Industrial origin
	SIC code
	Other process material
	Process description (extended)
Chemical producer information	Chemical producer name
	Chemical producer I.D. number
	City location
	State location
	Zip code
	County location
	River basin name
	River basin code
	AQCR code
	Process capacity
	Parent company

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SECTION 2

CONCLUSIONS AND RECOMMENDATIONS

The efforts on the Rubber-Processing Chemicals Data Base (RPCDB) have resulted in a body of information on 327 distinct organic products. This compilation is believed to include all of the organic chemicals produced or imported in the United States at commercially significant levels in 1979-80 which are used in processing natural or synthetic rubber (see definition of end use criteria in Section 3 below). As far as is known, it is the only comprehensive body of data on this sector of the chemical industry, embracing chemical, economic, use, process-related, and producer-related categories of information.

The RPCDB is the second data base SRI International has developed as a subset of the Organic Chemical Producers Data Base; previous experience on the Organic Dyes and Pigments Data Base facilitated this effort, and allowed numerous potential difficulties in the areas of data formatting, entry, and editing to be avoided. It would not be difficult to develop future data bases on the same model to treat other sectors of the chemical industry; it is likely that each sector has idiosyncracies which tend to make certain kinds of data collection more and less feasible, but it is also likely that the general steps established in these two experiences would have a broad application.

The major difficulty encountered in obtaining data, as was true also with the ODPDB, was due to the proprietary nature of the specific industry involved. This is probably a general rule when dealing with specialized products of limited application and commercial volume, and reflects the competitive nature of the industry. Exact knowledge of production volumes, manufacturing processes used by specific plants, and consumption patterns are simply not in the public domain. A future study could perhaps benefit if in-house expertise with direct experience in the given industry were available, but even this would probably only shed light on a few specific products or classes of products, and would be more likely to provide general indications than hard numerical data.

The specific solutions adopted to handle difficulties arising in data collection and formatting are discussed in appropriate sections below. It is recommended that there be some flexibility in the field length requirements of the software; this would allow for variation in descriptive needs between different sectors of the chemical industry. The field lengths currently employed are suitable for brief descriptions of large-volume chemicals, but tend to cut off information and blur distinctions that have been carefully researched in areas where the products are more complex and differences in properties more subtle. Two examples from the present effort

illustrate this point: some of the chemical synonyms for rubber-processing chemicals are unusually long, and had to be truncated to the extent that they became unrecognizable; and the use comment sections had to be extremely condensed and abbreviated in order to convey meaningful information about the differences in properties of various products within a large use function category such as antioxidants or accelerators.

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SECTION 3

SCOPE OF THE RUBBER-PROCESSING CHEMICALS DATA BASE (RPCDB)

In order to define the scope of this task, qualifying criteria were established for including chemicals in the data base. These criteria were based on economic and end-use considerations.

The economic criteria allow only commercially significant candidates to be included in the study. For these purposes, commercial significance is defined as recent (1977-1980) U.S. production or imports of at least 1,000 pounds or $1,000 in value of sales.[a] Sources used to verify agreement with these criteria included the following:

a. U.S. international Trade Commission, Synthetic Organic Chemicals, U.S. Production and Sales, 1977-1980

b. U.S. International Trade Commission, Imports of Benzenoid Chemicals and Products, 1979-1980

c. SRI International, Directory of Chemical Producers--USA, 1979-1981.

Candidates meeting the economic criteria must be used in the processing of rubber to be included in the data base; monomers for the production of elastomeric polymers and the polymers themselves were excluded. In addition, dyes and pigments used to color rubber were excluded, since it was assumed that these had received sufficient coverage in the Organic Dyes and Pigments Data Base being developed by SRI. Sources used to verify agreement with these criteria included:

a. Slaybaugh, C. S., et al. (eds.), Rubber World Blue Book, 1981 Edition

b. Sweum, A. (ed.), 1981 Rubber Red Book, 33rd Edition.

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a. These minimum values are the same as those set for rubber-processing chemicals by the U.S. International Trade Commission in their publication, Synthetic Organic Chemicals, U.S. Production and Sales.

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SECTION 4

DATA COLLECTION

APPROACH

In 1980 and early 1981, SRI International participated in a project funded by the National Cancer Institute (NCI) in which rubber-processing chemicals were studied in considerable detail.

The NCI-sponsored project was part of a continuing program at the International Agency for Research on Cancer (IARC) in Lyon, France, in which comprehensive monographs are prepared on individual chemicals, classes of chemicals, and industrial segments involving occupational exposure to chemicals in order to evaluate the carcinogenic risk of the chemicals to humans. The program includes preparation of the different sections of the draft monographs by experts in the particular field, an eight-day working group meeting in Lyon at which the drafts are reviewed and revised by world authorities in carcinogenicity, epidemiology, and related fields, and subsequent publication (about 9-12 months after the meeting) of a volume of the IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. For the meeting on rubber-processing chemicals, held in June 1981, SRI International prepared an Appendix listing chemicals (including CAS number, synonyms, trade names, and structure) used commercially in the rubber industry, their annual production levels, the individual processes in which they are used, levels or occurrence in workplace air, and occupational standards. Also included was information on (a) by-products produced during rubber product manufacturing, (b) the principal monomers used in elastomer production and (c) selected plasticizers. A representative from SRI International participated in the revision of the drafts at the meeting in Lyon. In addition to the work on the IARC monographs, SRI gathered considerable relevant information in 1978 when a class study on rubber-processing chemicals was prepared for the NCI as part of the NCI process of selecting chemicals for long-term animal bioassays.

Table 2 lists the organic chemicals included in the IARC Monograph Appendix by structural class. Although the ultimate decision was to enter the RPCDB chemicals in alphabetical order to preserve consistency with other segments of the OCPDB, this structural grouping proved useful for data collection, since it allowed chemicals with related methods of manufacture and/or uses to be researched at the same time.

The IARC chemicals formed a base list for the RPCDB. Some modifications were made in the list of chemicals when the economic criteria were applied; a number of chemicals included in the IARC Appendix were derived from European sources, and no evidence was found for their commercial use in the

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TABLE 2. IARC RUBBER-PROCESSING CHEMICALS ARRANGED BY STRUCTURAL CLASS

A. Nitrogen compounds

1. Phenylenediamines
2. Diphenylamines
3. Other aromatic amines
4. Aromatic amine-aldehyde (ketone) condensates
5. Quinolines
6. Arylguanidines
7. Alkyl amines
8. Carbamates
9. Miscellaneous

B. Sulphur compounds

1. Mercaptans
2. Thiocarbamates
3. Benzothiazoles
   a. Sulphenamides
   b. Miscellaneous
4. Xanthates
5. Sulphides and disulphides
   a. Thioethers
   b. Thiurams
   c. Miscellaneous
6. Thioureas
7. Miscellaneous

C. Oxygen compounds

1. Phenols
   a. Carbon-bridged phenols
   b. Alkylated phenols
   c. Aminophenols
   d. Hydroquinones
   e. Miscellaneous
2. Quinones
3. Carboxylic acids and salts
4. Anhydrides and esters
5. Peroxides
6. Aldehydes and ketones
7. Alcohols
8. Miscellaneous

D. Phosphorus compounds

1. Phosphites
2. Phosphates and phosphonates

E. Halogen compounds

F. Hydrocarbons

G. Miscellaneous organic compounds

United States. In addition, the EPA Project Officer decided that plasticizers should be added to the RPCDB; these were discussed in the IARC Monograph but not featured in the Appendix. A list of 36 plasticizers believed to be used with elastomeric materials was developed from the 1981 Rubber World Blue Book. When duplications with chemicals already included in the IARC Appendix as softeners were eliminated and the economic criteria were applied, this list produced 22 candidate plasticizers for the RPCDB.

Of the total RPCDB candidate list of 327 chemicals, 52 were found to have already been included in the OCPDB as large-volume chemicals. Agreement was reached with the EPA Project Officer that the only data to be included in the RPCDB on these chemicals would be updates to the current OCPDB listings and specific synonyms and end use data relating to rubber-processing applications.

CHEMICAL INFORMATION

This step involved identifying the rubber-processing chemicals by their chemical names, Chemical Abstracts Service Registry Numbers (CAS Numbers), synonyms and tradenames, NIOSH Registry Numbers, and Wiswesser Line Notations (WLN), and assigning chemical identification numbers to the candidates. It was agreed that the short form of the chemical name would be used as the main listing, as these names are most frequently used in commerce and would most readily fit the spacing requirements for entry in the data base. The current (Ninth Index) Chemical Abstracts names and International Union of Pure and Applied Chemistry (IUPAC) names, when these differed from the main chemical name, were included as synonyms.

In general, main chemical names, CAS numbers, synonyms, and current tradenames for the candidate chemicals were obtained from the IARC Appendix. Data which were lacking were sought from CHEMLINE, a data base of the National Library of Medicine. An attempt was made to limit inclusion of synonyms and tradenames to those in current commercial use; a small number of tradenames found to be used in the literature was subsequently added to those appearing in the IARC Appendix (see section below on Use Data for sources consulted). NIOSH Registry Numbers and Wiswesser Line Notations were obtained from:

> National Institute for Occupational Safety and Health. 1980. Registry of Toxic Effects of Chemical Substances. Rockville, Maryland.

No attempt was made to derive WLNs for those chemicals not included in the NIOSH registry.

Chemical identification numbers were assigned to new chemicals in units of five beginning with number 20000, in order to distinguish the RPCDB from the Organic Dyes and Pigments Data Base, for which identification numbers between 10000 and 18000 were used. Supplemental data on chemicals already included in the OCPDB were entered under the OCPDB identification numbers. Two data elements in the current OCPDB were not applied to the RPCDB: new chemical markers were considered irrelevant since all the RPCDB chemicals were new with exception of the updates; and none of the new RPCDB chemicals met the criteria for priority pollutant markers.

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ECONOMIC INFORMATION

The economic data that were collected included 1980 figures (or earlier years if 1980 figures were unavailable) for U.S. production, sales value, and unit cost. The sources reviewed for economic data included:

U.S. International Trade Commission. 1980 and 1981. Imports of Benzenoid Chemicals and Products, 1979 and 1980. USITC Publication Numbers 1083 and 1163. U.S. Government Printing Office. Washington, D.C.

U.S. International Trade Commission. 1978 through 1981. Synthetic Organic Chemicals, U.S. Production and Sales, 1977, 1978, 1979, and 1980. USITC Publication Numbers 920, 1001, 1009, and 1183. U.S. Government Printing Office. Washington, D.C.

SRI International. 1979 and 1980. Directory of Chemical Producers--U.S.A., 1979 and 1980. Menlo Park, California.

SRI International. Continually updated. Chemical Economics Handbook. Menlo Park, California.

Actual production figures were not available for the majority of chemicals. Instead, production was expressed in terms of a minimum figure established by the U.S. International Trade Commission in their publication, Synthetic Organic Chemicals, U.S. Production and Sales; the minima they employ are 1,000 pounds for rubber-processing chemicals and 5,000 pounds for plasticizers, chemical intermediates, and miscellaneous chemicals. The latter figure was adopted for all products in the Directory of Chemical Producers. The minimum figure was multiplied by the number of listed producers, e.g., "greater than 4,000 pounds" when four companies reported production of a given chemical in the Rubber-Processing Chemicals Section of Synthetic Organic Chemicals.

No economic data are included for a small number of chemicals which nevertheless were believed to be sufficiently important in commerce to be included in the RPCDB. These include chemicals not produced in the United States but imported in commercial quantities, those for which only estimated consumption was available, those for which the TSCA Chemicals in Commerce Information System (CICIS) data base was the sole source of economic data, and a few natural products which are known to be used but for which no figures were available.

CHEMICAL PRODUCER INFORMATION

The chemical producer information that was sought included producer names, identification numbers, city, county, and state locations, zip codes, river basin names and codes, Air Quality Control Region (AQCR) codes, parent companies, and process capacity. Many of the plant sites involved were already in the OCPDB, with the result that the appropriate identification codes could be entered directly. New plant site data were entered along with interpolated identification numbers. Sources for these data are discussed below.

Company Name, Plant Location, Plant Capacity, and Parent Company

The company names obtained corresponded to those producers reporting production in the years included in the data base (i.e., either 1980 or 1979). The sources searched for company name, plant location, plant capacity, and parent company were as follows:

U.S. International Trade Commission. 1980 and 1981. Synthetic Organic Chemicals, U.S. Production and Sales, 1979 and 1980. USITC Publication Numbers 1099 and 1183. U.S. Government Printing Office, Washington, D.C.

SRI International. 1979 and 1980. Directory of Chemical Producers--U.S.A., 1979 and 1980. Menlo Park, California

SRI International. Continually updated. Chemical Economics Handbook. Menlo Park, California.

River Basin Code and Name, and AQCR Code

A combination of the following sources was used to obtain "river basin" (state hydrological unit) codes and names, and AQCR codes:

Commercial Atlas & Marketing Guide. 1979-1981. 110th-112th Editions. Rand McNally & Co. Chicago, Illinois

U.S. Geological Survey (USGS). 1979-1980. Catalog of Information on Water Data. Index to Water Data Acquisition. Water Resources Divisions 01-07, 11 and 18. Office of Water Data Coordination, Reston, Virginia

U.S. Geological Survey (USGS). Water Resources Division. Computer printout: State hydrological unit codes and names. Retrieved October 1982. Menlo Park, California

U.S. Environmental Protection Agency. September 1981. Directory of Air Quality Monitoring Sites 1981 EPA-450/4-81-033. Office of Air Noise and Radiation, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina.

A process of extrapolation from maps and fixed monitoring locations was used to determine these two sets of codes, and inevitably some errors have been incorporated. Unfortunately no claim can be made for accuracy in such cases as that in which a plant site location was found to be on the boundary between two regions.

PRODUCT PROCESS INFORMATION

This task involved describing the processes used to manufacture rubber-processing chemicals, determining the method used at specific plants, and listing the reaction components and other materials employed in manufacturing the chemicals.

The major intermediates used in the processing methods were compared with the product slates of the companies manufacturing the candidate RPCDB chemical. When the product slates from any plant belonging to the company indicated manufacture of a key intermediate, the company was associated in the data base with that specific process. If none of the product slates included the key intermediates for any process, the process used by the plant in question was considered to be unspecified. Product slates for chemical manufacturing plants were found in SRI International's 1979 and 1980 Directory of Chemical Producers--USA.

Process Description

The following major references were used to determine specific and general processing descriptions:

Kirk-Othmer Encyclopedia of Chemical Technology. 1963-1972. Volumes 1-22 and supplement, Second Edition. John Wiley and Sons, Inc. New York

Kirk-Othmer Encyclopedia of Chemical Technology. 1978-Present. Volumes 1-20. Third Edition. John Wiley and Sons, Inc. New York

Encyclopedia of Polymer Science and Technology. 1964-1977. Volumes 1-16 and supplements. John Wiley and Sons, Inc. New York

Heinisch, K. F. 1974. Dictionary of Rubber. John Wiley and Sons, Inc. New York

Morton, M. 1973. Rubber Technology. Second Edition. Van Nostrand Reinhold Company. New York

Chemical Technology: An Encyclopedic Treatment. 1972. Volume 4. Barnes and Noble. New York

SRI International. 1982. SRI International source.

In addition, the following references were used, but contained limited processing information:

Sittig, M. 1980. Pesticide Manufacturing and Toxic Materials Control Encyclopedia. Noyes Data Corporation. New Jersey

IARC Monographs on the Evaluation of the Carcinogenic Risks to Humans. 1982. Volume 29, IARC. Lyon, France

Liepens, R., et al. 1977. Industrial Process Profile for Environmental Use. Chapter 6: The Industrial Organic Chemistry Industry. Research Triangle Institute in cooperation with Radian Corporation. U.S. Environmental Protection Agency. Contract No. 68-02-1325. NTIS Report No. PB-218 478.

Furia, T. E., et al. 1975. Fenaroli's Handbook of Flavor Ingredients. Second Edition. CRC Press, Inc. Ohio.

Windholz, M., editor, 1976. The Merck Index. Ninth Edition. Merck & Company, Inc. Rahway, New Jersey.

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Process descriptions were labeled "PR" for "probable process" when the searched references gave only a general process description for a class of chemicals. For instance, unsymmetrical p-phenylenediamines are produced by the reaction of a ketone with p-aminodiphenylamine; therefore, the process for production of N-(1,3-dimethylbutyl)-N-phenyl-p-phenylenediamine, labeled "PR," would read: reaction of 5-methyl-2-pentanone with p-aminodiphenylamine.

Reaction Components

Listed are the major chemical components used to produce the candidate chemical.

OCPDB and ICPDB Numbers

These identification numbers indicate that the reaction component is included in either the Organic Chemical Producers Data Base (OCPDB) or the Inorganic Chemical Producers Data Base (ICPDB).

Industrial Origin and SIC Numbers

Each reaction component was classified by its industrial origin and corresponding Standard Industrial Classification (SIC) number in order to standardize the nomenclature used to describe the origins and fate of each component.

Other Processing Materials

Includes all other chemicals not included as reaction components, such as catalysts, pH modifiers, and precipitants, and additionally any other materials utilized in an ancillary manner for production of the candidate chemical, e.g., steam for distillation.

USE INFORMATION

Use information was gathered for rubber-processing and rubber end product applications. Major sources for rubber-processing uses were the Blue Book and the Dictionary of Rubber. When non-rubber usages were encountered in the process of searching for rubber usages, this information was also encoded. If the specific function of a chemical in rubber processing could not be confirmed or clarified, the description was annotated by "unspecified use." A glossary of terms for specific use functions, applications, and general comments was derived to facilitate the maximum inclusion of all use information gathered (see Appendix B). Figures for use amount and percent domestic use were sought but no data were available.

The following sources were used to gather use information for rubber and non-rubber applications:

Del Gatto, J. V., ed. 1970. Materials and Compounding Ingredients for Rubber. Bill Communications, Inc. New York

Encyclopedia of Polymer Science and Technology. 1964-1972. Volumes 1-16 and supplements. John Wiley and Sons, Inc. New York

Hawley, G. G., ed. 1981. The Condensed Chemical Dictionary. Tenth Edition. Van Nostrand Reinhold Company. New York

Heinisch, K. F. 1974. Dictionary of Rubber. John Wiley and Sons, Inc. New York

Kirk-Othmer Encyclopedia of Chemical Technology. 1963-1972. Volumes 1-22 and supplement. Second Edition. John Wiley and Sons, Inc. New York

Kirk-Othmer Encyclopedia of Chemical Technology. 1978-Present. Volumes 1-20. Third Edition. John Wiley and Sons, Inc. New York

Pattison, E., ed. 1959. Industrial Fatty Acids and Their Applications. Reinhold Publishing Corporation. New York

Sittig, M. 1980. Pesticide Manufacturing and Toxic Materials Control Encyclopedia. Noyes Data Corporation. Park Ridge, New Jersey

Smith, D. R., ed. 1981. Blue Book 1981. Bill Communications, Inc. New York

Smith, D. R., ed. 1982. Blue Book 1982. Bill Communications, Inc. New York.

SRI International. Continuously Updated. Chemical Economics Handbook. SRI International. Menlo Park, California

Sweum, A., ed. 1981. 1981 Rubber Red Book. Thirty-Third Edition. Communication Channels, Inc. Atlanta, Georgia

U.S. Environmental Protection Agency. July 1975. Environmental Aspects of Chemical Use in Rubber Processing Operations (March 12-14, 1975, Akron, Ohio). PB-244172. National Technical Information Service. Springfield, Virginia.

U.S. Executive Office of the President. 1972. Standard Industrial Classification Manual, 1972. U.S. Government Printing Office. Washington, D.C.

Windholz, M., ed. 1976. The Merck Index. Ninth Edition, Merck & Company, Inc. Rahway, New Jersey.

Worthing, C. R., ed. 1979. The Pesticide Manual. Sixth Edition. The British Crop Protection Council. Great Britain.

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SECTION 5

DATA FORMAT AND TRANSMITTAL

DATA FORMAT

The data collected in the previous steps were coded in a format compatible with software currently employed on the OCPDB. Although certain modifications in field lengths would have been convenient (such as an increase in the spacing allotted to synonyms to permit entry of complete names), no such modifications were made. The only formatting alteration approved by the EPA Project Officer was the addition of a thirty-eighth space to the entry line for economic data; this made it possible to encode a 'greater than' sign ('>') in order to express minimum production figures. IPPEU numbers were not used because there were very few cases in which RPCDB data could be coordinated with IPPEU processes.

COMPUTER ENTRY AND TRANSMITTAL

Professional key operators were used for data entry rather than the direct entry program used for the organic dyes and pigments data base (ODPDB). This task was contracted to an outside vendor, Superior Keypunch Services of Los Gatos, California. Since the data were collected on formatted coding sheets in the initial phases, the entry operation was able to proceed with minimal difficulty. The coding sheets incorporated the numerical entry codes, field lengths, and ordering of the data elements appropriate for key entry.

Editorial corrections were made on data printouts obtained from the vendor, and changes accomplished via text-editing to the material stored on disc.

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APPENDIX A

CHEMICALS IN THE RUBBER-PROCESSING CHEMICALS DATA BASE

ID Number	Name
00070	Acetic acid
00090	Acetone
20000	Alkyl alcohols, mixed
20005	Alkyl aryl-p-phenylenediamines
20010	Alkylaryl phosphites, mixed
20015	Alkylated diphenylamine
20020	Alkyl mercaptans, mixed
20025	Alkylphenolsulphides
20030	Ammonium acetate
20035	p-t-Amylphenol sulphide
20040	Aromatic polyamine, hindered
20045	Aryl disulphides, mixed
20050	Aryl mercaptans
20055	1,1′-Azobisformamide
20060	2,2′-Azobisisobutyronitrile
00380	Benzene
20065	Benzenesulphonyl hydrazide
20070	2-Benzimidazolethiol, zinc salt
20075	Benzofurane derivative
00430	Benzoic acid
20080	p-Benzoquinonedioxime
20085	2-Benzothiazyl-N,N-diethylthiocarbamoyl sulphide
00495	Benzoyl peroxide
20090	p-Benzyloxyphenol
20095	Bis(4-aminocyclohexyl)methane carbamate
20100	1,3-Bis(2-benzothiazolylmercaptomethyl)urea

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TYPING GUIDE SHEET

ID Number	Name
20105	4,4′-Bis(sec-butylamino)diphenyl-methane
20110	Bis(cinnamylidine)hexamethylenediamine
20115	Bis(2,4-dichlorobenzoyl) peroxide
20120	Bis(diethylthiocarbamoyl) disulphide
20125	Bis(diethylthiocarbamoyl) disulphide and Bis(dimethylthiocarbamoyl) disulphide
20130	N,N′-Bis(1,4-dimethylpentyl)-p-phenylenediamine
20135	Bis(dimethylthiocarbamoyl) disulphide
20140	Bis(dimethylthiocarbamoyl) sulphide
20145	Bis(dimethylthiocarbamoyl) tetrasulphide
20150	N,N′-Bis(1-ethyl-3-methylpentyl)-p-phenylene-diamine
20155	Bis(ethylmethylthiocarbamoyl) sulfide
20160	Bis(isopropyloctadecylthiocarbamoyl) disulphide
20165	N,N′-Bis(isopropyl)-p-phenylenediamine
20170	N,N′-Bis(1-methylheptyl)-p-phenylenediamine
20175	Bis(methylphenylthiocarbamoyl) disulphide
20180	N,N′-Bis(1-methylpropyl)-o-phenylenediamine
20185	N,N′-Bis(1-methylpropyl)-p-phenylenediamine
20190	Bis(morpholinothiocarbamoyl) disulphide
20195	Bisphenol, hindered
20200	Bitumen
00640	Butyl alcohol
20205	N-t-Butyl-2-benzothiazolesulphenamide
00705	Butyl benzyl phthalate
20210	6-tert-Butyl-m-cresol--sulphur dichloride condensate
20215	4,4′-Butylidenebis(6-t-butyl-m-cresol)
20220	Butyl oleate
20225	tert-Butyl peroxide
20230	tert-Butyl peroxybenzoate
20235	N-sec-Butyl-N′-phenyl-p-phenylenediamine
20240	Butyl stearate
20245	Butyraldehyde-aniline condensate

ID Number	Name
20250	n-Butyraldehyde-aniline condensate
20255	n-Butyraldehyde-butylamine condensate
20260	N-Butyroyl-p-aminophenol
00784	Calcium stearate
00790	Carbon bisulphide
20265	Carbon disulphide and 1,1′-methylenedipiperidine (reaction product)
00810	Carbon tetrachloride
20270	Casein
00815	Castor oil
20275	4-Chloro-2,6-bis(2,4-dihydroxybenzyl)phenol
00930	Chloroform
00970, 00980, 00990	Chlorotoluenes
20285	Coal tar oils
20290	Cotton fiber
20295	Cottonseed oil
20300	Coumarone-indene resins
20305	o-Cresol, alkylated
20310	p-Cresol, alkylated
01120	Cyclohexane
01140	Cyclohexanone
20315	N-Cyclohexyl-2-benzothiazolylsulphenamide
20320	N-Cyclohexyl-N′-phenyl-p-phenylenediamine
20325	N-(Cyclohexylthio)phthalimide
20330	Dialkylthiourea
20335	Diamyldithiocarbamic acid, zinc salt
20340	Diaryl and alkylaryl p-phenylenediamines, blended
20345	Diarylamine-ketone condensate
20350	Diarylenediamines, mixed
20355	Diaryl-p-phenylenediamine, mixed
20360	Dibenzo-p-quinone
20365	Dibenzoyl-p-quinone dioxime

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ID Number	Name
20368	Dibenzylamine
20370	Dibenzyldithiocarbamic acid, sodium salt
20375	Dibenzyldithiocarbamic acid, zinc salt
20380	Di(butoxyethoxyethyl) adipate
20385	Di(butoxyethyl) sebacate
20390	Di-n-butylamine
20395	Di-n-butylammonium oleate
20400	2,6-Di-tert-butyl-p-cresol
20405	2,5-Di-sec-butyl decylhydroquinone
20410	Di-n-butyldithiocarbamic acid, molybdenum salt
20415	Dibutyldithiocarbamic acid, nickel salt
20420	Dibutyldithiocarbamic acid, potassium salt
20425	Di-n-butyldithiocarbamic acid, sodium salt
20430	Di-n-butyldithiocarbamic acid, zinc salt
20435	3,5-Di-tert-butyl-4-hydroxybenzyl phosphonic acid, monoethyl ester, nickel salt
20440	1,1-Di-tert-butylperoxy-3,3,5-trimethylcyclohexane
01197	Dibutyl phthalate
20445	Dibutyl sebacate
20450	1,3-Di-n-butyl-2-thiourea
20455	Di-n-butylxantho disulphide
20460	Dicatechol borate, di-o-tolylguanidine salt
20465	Dicumyl peroxide
20470	N,N-Dicyclohexyl-2-benzothiazolylsulphenamide
20475	N,N′-Dicyclohexyl-p-phenylenediamine
20480	2,5-Di(1,1-dimethylpropyl)hydroquinone
20485	Diethyldithiocarbamic acid, cadmium salt
20490	Diethyldithiocarbamic acid, cadmium salt and bis(diethylthiocarbamoyl) disulphide, mixture
20495	Diethyldithiocarbamic acid, nickel salt
20500	Diethyldithiocarbamic acid, selenium salt
20505	Diethyldithiocarbamic acid, sodium salt
20510	Diethyldithiocarbamic acid, tellurium salt
20515	Diethyldithiocarbamic acid, zinc salt

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ID Number	Name
20520	Di-2-ethylhexyl adipate
00558	Di-2-ethylhexyl phthalate
20525	N,N-Diethylhydroxylamine
01380	Diethyl phthalate
20530	1,3-Diethyl-2-thiourea
20535	1,2-Dihydro-6-dodecyl-2,2,4-trimethylquinoline
20540	1,2-Dihydro-6-ethoxy-2,2,4-trimethylquinoline
20545	1,2-Dihydro-2,2,4-trimethylquinoline
20550	Diisobutyl dithiocarbamic acid, nickel salt
20555	Diisobutyl phthalate
01444	Diisooctyl phthalate
20560	N,N-Diisopropyl-2-benzothiazolesulphenamide
20565	Diisopropylxantho disulphide
20570	2,5-Dimercapto-1,3,4-thiadiazole
20575	Dimethylammonium hydrogen isophthalate
20580	N-(1,4-Dimethylamyl)-N′-phenyl-p-phenylenediamine
20585	N-(1,3-Dimethylbutyl)-N′-phenyl-p-phenylenediamine
20590	2,5-Dimethyl-2,5-di(tert-butylperoxy)hexane
20595	Dimethyldithiocarbamic acid, bismuth salt
20600	Dimethyldithiocarbamic acid, copper salt
20605	Dimethyldithiocarbamic acid, dimethylammonium salt
20610	Dimethyldithiocarbamic acid, lead salt
20615	Dimethyldithiocarbamic acid, potassium salt
20620	Dimethyldithiocarbamic acid, selenium salt
20625	Dimethyldithiocarbamic acid, sodium salt
20630	Dimethyldithiocarbamic acid, sodium salt and sodium polysulphide mixture
20635	Dimethyldithiocarbamic acid, zinc salt
20640	Dimethylethanolamine, toluene-2,4-diisocyanate adduct
01490	Dimethylformamide
20645	Dimethyl sebacate
20650	1,3-Dimethylthiourea
20655	N,N′-Di-2-naphthyl-p-phenylenediamine

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TYPING GUIDE SHEET

ID Number	Name
20660	Dinitrosopentamethylene terephthalamide
20665	Dinitrosopentamethylenetetramine
20670	p,p′-Dioctyldiphenylamine
20675	3,7-Dioctylphenothiazine
20680	Dioctyl sebacate
20685	Di-N,N′-pentamethylenethiuram hexasulphide
20690	Di-N,N′-pentamethylenethiuram tetrasulphide
20695	Dipentene
20700	Diphenylamine-acetone condensate
20705	Diphenylamine, styrenated
20710	Diphenylamine, substituted
20715	1,3-Diphenylguanidine
20720	N,N′-Diphenyl-p-phenylenediamine
20725	N,N′-Diphenyl-1,3-propanediamine
01600	1,3-Diphenyl-2-thiourea
20730	Disodium 2,5-dimercapto-1,3,4-thiadiazole
20735	2′,2‴-Dithiobis(benzanilide)
20740	2,2′-Dithiobis(benzothiazole)
20745	1,3-Di-o-tolylguanidine
01615	Ditridecyl phthalate
20750	Dixylyl disulphides, mixed
01635	n-Dodecyl mercaptan
20755	tert-Dodecyl mercaptan
20760	Epoxidized soybean oil
01670	Ethyl acetate
01660	Ethyl alcohol
20765	N-Ethylcyclohexylamine
20770	3-Ethyl-1,1-dimethyl-2-thiourea
20775	Ethylenediamine carbamate
01244	Ethylene dichloride
20780	1,3-Ethylene-2-thiourea
20785	Ethylphenyldithiocarbamic acid, zinc salt
20790	Fluorinated hydrocarbons
02040	Formaldehyde

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ID Number	Name
02090	Glycerine
20795	Heptaldehyde-aniline condensate
20800	Heptane
20805	tert-Hexadecyl mercaptan
20810	Hexamethylenediamine carbamate
02180	Hexamethylenetetramine
20815	Hexamethylenimine
20820	Hexane
20825	1,6-Hexanediol bis-[3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate]
02200	Hydroquinone
20830	p-Hydroxydiphenylamine
20835	Isooctane
02360	Isopropyl alcohol
20840	N-Isopropyl-N′-phenyl-p-phenylenediamine
20845	Lanolin
20850	Lauric acid
20855	N-Lauroyl-p-aminophenol
20860	2-Mercaptobenzimidazole
20865	2-Mercaptobenzothiazole
20870	2-Mercaptobenzothiazole, copper salt
20875	2-Mercaptobenzothiazole, sodium salt
20880	2-Mercaptobenzothiazole, zinc chloride
20885	2-Mercaptobenzothiazole, zinc salt
20890	2-Mercaptotoluimidazole
20895	2-Mercaptotoluimidazole, zinc salt
20900	Methacrylic acid, zinc salt
02500	Methyl alcohol
20905	2,2′-Methylenebis(6-t-butyl-p-cresol)
20910	2,2′-Methylenebis(6-t-butyl-4-ethylphenol)
20915	4,4′-Methylenebis(2-chloroaniline)
20920	4,4′-Methylenebis(2,6-di-tert-butyl phenol)
20925	2,2′-Methylenebis-6-(1-methylcyclohexyl)-p-cresol
20930	2,2′-Methylenebis(4-methyl-6-nonylphenol)

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ID Number	Name
02620	Methylene chloride
02630	4,4′-Methylenedianiline
20935	4,4′-Methylenedicarbanilic acid, diphenyl ester
02640	Methyl ethyl ketone
20940	N-(1-Methylheptyl)ethanolamine
20945	N-(1-Methylheptyl)-N′-phenyl-p-phenylenediamine
02660	Methyl isobutyl ketone
20950	N-(2-Methyl-2-nitropropyl)-4-nitrosoaniline
20955	Methyl oleate
20960	N-(1-Methylpentyl)-N′-phenyl-p-phenylenediamine
20965	Mineral oil
20970	Mineral rubber
00890	Monochlorobenzene
20975	Mono- and dialkyl phosphate, ammonium salts, mixed
20980	Morpholine disulphide
20985	4-Morpholinyl-2-benzothiazyl disulphide
20990	Naphtha
02805	N-Nitrosodiphenylamine
20995	Nonylated diethyldiphenylamine
21000	Nonyldiphenylamine mixture (mono-, di-, & tri-)
21005	tert-Nonyl mercaptan
21010	Nonylphenyl phosphites, mixed
21015	Octylated diphenylamine
21020	n-Octyl-n-decyl adipate
21025	Octyldiphenylamine, alkylated
21030	Octyldiphenylamine mixtures (mono-, nonyl-, & di-)
21035	n-Octyl mercaptan
21040	tert-Octyl mercaptan
21045	Oleonitrile
21050	p,p′-Oxybis(benzenesulphonylhydrazide)
21055	N-Oxydiethylene-2-benzothiazolesulphenamide
21060	N-Oxydiethylenethiocarbamoyl-N′-oxydiethylene-sulphenamide
21065	Pentachlorobenzenethiol

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ID Number	Name
02851	Pentane
02860	Perchloroethylene
21070	Petrolatum
21075	Phenol, alkylated
21080	Phenol-formaldehyde resins
21085	Phenol, hindered
21090	Phenol, polymeric, hindered
21095	Phenol, styrenated, mixtures
21100	m-Phenylenebismaleimide
21105	N-Phenyl-1-naphthylamine
21110	N-Phenyl-2-naphthylamine
21115	N-Phenyl-2-naphthylamine-acetone condensate
21120	N-Phenyl-p-phenylenediamine
02960	Phthalic anhydride
21125	Pine tar
21130	Piperidinecarbodithioic acid, piperidinium potassium salts, mixed
21135	Piperidinium pentamethylene dithiocarbamate
21140	Pitch
21145	Poly-p-dinitrosobenzene
03010	Polyethylene glycol
21150	Polymeric phosphites
21155	Polyphenol, alkylated
21160	Polyphenolic phosphite, polyalkylated
21165	Poly(2,2,4-trimethyl-1,2-dihydroquinoline)
03110	Propylene dichloride
03130	Pyridine
03150	Resorcinol
21170	Ricinoleic acid
03170	Salicylic acid
21175	Silicones
21180	Sodium alkyl sulphates
21185	Sodium pentachlorophenate
21190	Stearic acid

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ID Number	Name
21195	N-Stearoyl-p-aminophenol
21200	Tetrabutylthiuram disulphide
21205	n-Tetradecyl mercaptan
21210	Tetraethylene glycol di-2-ethylhexoate
21215	Tetrahydrofuran
21220	Thiobenzathiazole
21225	4,4′-Thiobis(6-t-butyl-m-cresol)
21230	Thiobisphenol
21235	Thiobisphenol, alkylated
03349	Toluene
21240	p-(p-Toluenesulphonamido)diphenylamine
21245	p-Toluenesulphonylhydrazide
21250	p-Toluenesulphonylsemicarbazide
21255	Triaryl phosphate
21260	Triaryl phosphites
21265	Tributoxyethyl phosphate
03395	1,1,1-Trichloroethane
03410	Trichloroethylene
21270	Tridecyl mercaptan
21275	Triethylene glycol di(caprate--caprylate)
21280	Triethylene glycol dipelargonate
21285	Tri-2-ethylhexyl phosphate
21290	Triethyltrimethylene triamine
21295	1,1,3-Tri(2-methyl-4-hydroxy-5-t-butylphenyl)-butane
21300	2,2,4-Trimethylpentanediol-1,3-diisobutyrate
21305	1,1,3-Trimethyl-2-thiourea
21310	1,3,5-Trimethyl-2,4,6-tris-(3,5-di-tert-butyl-4-hydroxybenzyl)benzene
21315	Tris(2,3-dibromopropyl) phosphate
21320	Tris(3,5-di-t-butyl-4-hydroxybenzyl)isocyanurate
21325	Trisnonylphenyl phosphite
03500	Urea
21330	Vulcanized vegetable oils

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ID Number	Name
21335	Waxes and paraffinic products
21340	Wood flour
21345	Wood rosin
03541	Xylene
03570	p-Xylene
21350	Xylenethiol
21355	Zinc diisopropyl xanthate
21360	Zinc laurate
21365	Zinc stearate

EPA Form 2350-4 (4-80)
(PREVIOUSLY CIN: EPA FORM 2371)
TYPING GUIDE SHEET

APPENDIX B

GLOSSARY FOR RUBBER-PROCESSING CHEMICALS DATA BASE

DESCRIPTIVE TERMS

& = And

ADHES = Adhesive(s)

ASSIST = Assistant

AUTO = Automobile

CD = Cadmium

CHEM = Chemical

CHLORO- = Chlorinated

COPOLYM = Copolymerization

CONSTRUCTN = Construction

CPD/CPDING/CPDS = Compound/Compounding/Compounds

CU = Copper

CYCLIC INT = Cyclic Intermediate

DERIV = Derivative

DEV'T = Development

EMULSION POLYM = Emulsion Polymerization

FDA = U.S. Food and Drug Administration

HAF BLACKS = High Abrasion Furnace Blacks

HAV = Hot Air Vulcanization

HIGH TEMP CURES = High Temperature Cures

HOT & COLD POLYM = Hot & Cold Polymerizations

HR/HRS = Hour/Hours

INDUST = Industrial

LCM = Liquid Curing Medium

MIN = Minute

MOL = Mole

MW = Molecular Weight

POLYM = Polymerization

PKG/PKGS = Package/Packages

PROD = Product

RBBR/RBBRS = Rubber/Rubbers

RXN = Reaction

S = Sulfur

SAF = Super Abrasion Furnace

SOLN = Solution

TEMP/TEMPS = Temperature/Temperatures

UNSAT'D = Unsaturated

VISC = Viscosity

W/ = With

W/O = Without

FUNCTIONS

ACC/ACCS = Accelerator/Accelerators

- CO-ACC
- ULTRA ACC
- DELAYED ACTION ACC
- SECONDARY ACC
- VULCANIZING ACC

ACT = Activator

- SLIGHT ACT

ACTIVE INGREDIENT

ADHESIVE ASSISTANT

AID: = Aid (Description follows)

ANTIBACTERIAL AGENT

ANTIDEGRADANT

ANTIFOAM AGENT

ANTIMILDEW AGENT

AOX = Antioxidant

AOZ = Antiozonant

AQUATIC MOLLUSCACIDE

BA = Blowing Agent

NITROGEN BA

BACTERICIDE

BIOCIDE

BLUEING INHIB = Blueing Inhibitor

BONDING AGENT

CAT = Catalyst

CO-CAT

COPOLYM CAT

CHEM INT = Chemical Intermediate

COAGENT (Description follows)

COLOR INHIB = Color Inhibitor

COPPER INHIB = Copper Inhibitor

CORROSION INHIB = Corrosion Inhibitor

CRACK INHIB = Crack Inhibitor

CTA = Chain Transfer Agent

CUR = Curing Agent

NONSULFUR CUR

CURING ADHESIVE

DIP COATING

DISPERSING AID

DRYING OIL

DUSTING AGENT

DYE COMP = Dye Component

DYE INT = Dye Intermediate

EXTENDER

EXTRUSION AID

FREE RAD INIT = Free Radical Initiator

FILLER

FLR = Flame Retarder/Retardant

MILD FLR

FOOD ADD = Food Additive

FROST INHIB = Frost Inhibitor

FUNGICIDAL INGREDIENT

FUNGICIDE

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FUNGUS INHIB = Fungus Inhibitor
GEL INHIB = Gel Inhibitor
HAIR-DYE INGREDIENT
INGREDIENT
INIT = Initiator
INTERMEDIATE
LACTASE SUPPORT
LATEX COAGULANT
LEVELING AGENT
LUB = Lubricant
    INTERNAL LUB
    LUB-AOX
    MOLD LUB
MEDICAL DIAGNOSTIC AGENT
MILDEWCIDE
MOLLUSCACIDE
MRA = Mold Release Agent
MW MODIFIER
PA = Processing Aid
PEP = Peptizer (Same as "CHEMICAL PLA")
PI = Polymerization Inhibitor
PLA = Plasticizer
    CELLULOSE PLA
    CHEMICAL PLA
    LOW TEMP PLA
    REPLA = Replasticizer
    RESIN PLA
PM = Polymerization Modifier
PPT AGENT = Precipitating Agent
PRESERVATIVE
    PRESERVATIVE COATING
PROCESSING OIL
PROPELLANT
PSS = Polymerization Short Stop
RAW POLYMER PROTECTOR

RCA = Reclaiming Agent

REACTANT

REINFORCER

ORGANIC REINFORCER

RESIN INHIB = Resin Inhibitor

RET = Retarder

SCORCH RET

SLIGHT RET

SLIMICIDE

SOF = Softener

SOL = Solvent

STB/STBS = Stabilizer/Stabilizers

CHEM STB

HEAT STB

SLIGHT STB

POLYMER STB

RAW POLYMER STB

STIFFENER

SULFUR DONOR

TACKIFIER

THICKENER

UV QUENCHER = Ultra Violet Light Quencher

VULC = Vulcanizer

NON-SULFUR VULC

XLINK = CROSSLINKER

XLINK INHIB = Crosslinking Inhibitor

POLYMER XLINK INHIB

ELASTOMERS

ABS = Acrylonitrile Butadiene Styrene Copolymer

BR = Butadiene Rubbers

CM = Chlorinated Polyethylene Rubbers

CR = Chloroprene Rubbers

CSM = Chlorosulfonated Polyethylene Rubbers

EPDM = Ethylene-Propylene-Diene Rubbers

EPDM-ENB = EPDM-Ethylenenorbornene Rubbers

EPM = Ethylene-Propylene Rubber

IIR = Isobutylene-Isoprene Rubbers = Butyl Rubber

BIIR = Brominated IIR

CHLORO-IIR or CIIR = Chlorinated IIR

IR = Isoprene Rubbers (Synthetic)

NB = Nitrile-Butadiene

NBR = Nitrile-Butadiene Rubbers

NP = Neoprene

NR = Isoprene Rubbers (Natural)

PFAP = Poly(fluoroalkoxyphosphazenes)

PSR = Polysulfide Rubbers

RCR = Reclaimed Rubbers

SBR = Styrene-Butadiene Rubbers

SIR = Styrene-Isoprene Rubbers

SR/SRS = Synthetic Rubber/Synthetic Rubbers

PLASTICS/RESINS

ABS PLASTICS = Acrylonitrile-Butadiene-Styrene Copolymer

ABS RESINS

ACRYLIC RESINS

ACRYLICS

CAB = Cellulose Acetate Butyrate

CALENDERED & PLASTISOL VINYL FOAMS

CELLULAR POLYOLEFINS & THERMOPLASTICS

CELLULOSE ACETATE

EVA = Ethylene-Vinyl Acetate (polymer)

HDPE = High Density Polyethylene

HIGH IMPACT POLYSTYRENE

HIGH PRESSURE PE = High Pressure Polyethylene

LDPE = Low Density Polyethylene

NITROCELLULOSE

PE = Polyethylene

POLYACRYLONITRILE

POLYESTER

POLYISOBUTYLENE

POLY(METHYL METHACRYLATE)

POLYSTYRENE

POROUS PLASTIC MASSES

PP = Polypropylene

PVAC = Polyvinyl Acetate

PVB = Polyvinyl Butyral

PVC = Polyvinyl Chloride

SAN POLYMERS = Styrene-Acrylonitrile Polymers

STYRENE

THERMOPLASTICS

VAC = Vinyl Acetate

VC = Vinyl Chloride

VINYL-ACRYLATE COPOLYMERS

VINYLIDENE CHLORIDE

VINYL POLYMERIZATION

VINYL POLYMERS

XLPE = Cross-Linked Polyethylene